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Description

PALLET FOR HANDLING ELECTRIC MOTOR ARMATURES ON AUTOMATIC PRODUCTION LINES

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This patent claims priority of Italian patent application PI2002A000043 which is incorporated by reference herein.

FIELD OF THE INVENTION

[0002] The present invention relates to equipment for automatic production lines of electric motor armatures and more precisely it relates to a mobile work piece carrier, or pallet, having supports capable of holding armatures, which belong to a family of different sizes worked on such lines and of safely retaining them.

[0003] Furthermore, the invention relates to a method for carrying armatures to be worked on, on a pallet.

BACKGROUND OF THE INVENTION

[0004] Automatic production lines exist where the parts to be worked on are arranged on mobile work piece carriers, hereinafter indicated as pallets, which hold them and carry them through one or several workstations. Typical parts to be worked on are electric motor armatures, which are made starting from a shaft on which an armature stack of star-shaped sheets is driven and eventually is wound with coils of lead wire.

[0005] More precisely, each pallet, that is initially located in a station of inlet for receiving an armature, proceeds on a conveyor belt that causes it to move selectively through the workstations. In each station, if necessary, the armature is offered to a machine that draws it from the pallet, works it and returns it again on the pallet that proceeds on the conveyor. During the working time of the work piece in a station, the pallet continues to rest on the conveyor located underneath, for example a conveyor belt, in sliding contact on the belt same, or it can be raised or withdrawn from the conveyor belt, for example put in a waiting station. At the end of the work cycle, the pallet is withdrawn or maintained on the conveyor belt because it can proceed up to a next workstation.

[0006] Production lines that are not flexible exist, i.e., prepared

to operate armatures having all the same size or armature families of substantially like size. In this case, at the start-up of the line the pallet are set for receiving armatures and are not modified up to the end of all the working period. When the size of the armatures is modified in a substantial way, the line is stopped and both the pallet and the machines are set for receiving and working the new armatures.

[0007] For this reason, manually adjustable pallets exist, like those described in EP267324, that comprise fixed supports that can be adjusted and then blocked in a precise position for receiving the armature. A manually adjustable pallet of traditional type, requires that the supports are loosened, for example, by means of screw coupling, in order to move them to a position in which they are then locked to steadily support the armature.

[0008] When, instead, the machines in the various stations of the line are of flexible type, i.e., they can be adapted quickly to operate with armatures of different size, also the pallet, therefore, must be adjusted in real time not much before receiving each armature.

[0009] To this object pallets are known with automatically adjustable supports. For example, pallets of this type are

described in EP348715, EP447805, and EP811463.

[0010] All these systems hold the armatures providing supports on which the free shaft ends rest.

[0011] In some cases, however, one of the shaft ends after winding is substantially hidden by the wire coil turns, and for this reason it cannot be put on onto the respective supports.

[0012] Furthermore, an adjustable pallet requires a station of automatic adjustment of the supports, or an operator that adjusts them manually.

[0013] Normally, automatic production lines work for families of work pieces of variable size within a predetermined range. The variable dimensions, in case of the armatures, are armature stack height, armature stack diameter, position of the armature stack and commutator on the shaft, shaft diameter, shaft length, shape of the shaft ends, etc.

[0014] Also a small variation of one or more of these parameters requires adjustment of the supports of the pallet, and leads to the choice of adjustable pallets according to the known systems.

[0015] A further drawback of the pallets of the prior art is that they provide systems for holding the armature at the free shaft ends. For some types of armatures, however, after

winding, one of the shaft ends is substantially hidden by the coils of the wound wire, making it impossible to put both ends on the respective supports.

[0016] SUMMARY OF THE INVETION

[0017] It is therefore a feature of the present invention to provide a pallet for handling electric motor armatures on automatic production lines that is used for a whole family of armatures having size and shape different from one another without the need of adjustment of the supports neither automatic nor manual.

[0018] It is also a feature of the present invention to provide a pallet for handling electric motor armatures on automatic production lines which can eliminate possible backlash when accepting the armature in order to guarantee a precise location like the adjustable pallet of prior art and to be cost effective.

[0019] These and other features are accomplished with one exemplary pallet for handling electric motor armatures on automatic production lines, according to the invention, said armatures having an axis and comprising a plurality of portions having axial symmetry, in particular a shaft and an armature stack of ferromagnetic sheets driven on said shaft, whose characteristic is that it has a base on

which suitable support means are mounted for engaging with at least one of said portions having axial symmetry and for keeping the armatures with axis substantially horizontal preventing it from moving during its transportation.

[0020] In a first type of exemplary embodiment the portion having axial symmetry engaging with the support means is the armature stack of sheets, the support means comprising:

[0021] -means for bearing the armature at the armature stack of sheets, and

[0022] -means for holding the armature stack preventing the armature from moving with respect to the support means.

[0023] In a first exemplary embodiment of the present invention, the support means are two jaws movable with respect to each other between a first and a second position, in the first position the jaws approaching radially the armature stack for engaging with it, in the second position the jaws being distanced for having the armature loaded/unloaded during a working step.

[0024] According to another exemplary embodiment, the jaws are mounted movable transversally with respect to the ar-

mature axis biased by resilient means, and move from the first to the second position forced by a releasing means which can move in a direction substantially orthogonal to the base of the pallet and that engages with a conjugated surface associated to the jaws. Therefore, in the second position the jaws are influenced by the resilient returning force that biases their moving away from each other. This way, when the releasing means withdraws to a starting nominal position or, in the presence of the armature stack, to the first position where they are closed on the armature stack, the jaws have a residual resilient force sufficient to hold the armature.

[0025] In particular, the releasing means may have tapered side faces along which rollers connected to each jaw can slide.

[0026] The releasing means are advantageously integral to a gripper of means for picking up the armature from above or from below.

[0027] Alternatively, each jaw has one end shaped in order to form substantially a bevel that makes easier the introduction from above the armature stack on the support means and the other end hinged to a horizontal axis. This way the jaws can move rotationally with respect to each other rotating about the hinge between the first and second po-

sition. In particular, the angular motion of each jaw is biased by a resilient force suitable for carrying the support means to close on the armature after having positioned the latter on the former.

[0028] The pallet thus arranged is capable of holding armatures with different stack diameters according to the resilient stroke between the first and the second position.

[0029] The means for bearing can comprise a fixed cradle, for example, formed by two rods that are arranged parallel to the armature shaft on which two generatrix lines of the armature stack rest. The rods of the cradle can bear armatures with different armature stack diameter, since the armature stack rests on the rods along its own generatrix lines.

[0030] A third exemplary embodiment of the present invention provides fixed means for bearing arranged as a cradle for the armature stack and having at least one portion of its surface that faces the armature provided with a magnet, so that the portion of the armature stack located at the magnet is attracted thus blocking the whole armature.

[0031] A further exemplary embodiment of the present invention provides that on the cradle at the magnets a member is arranged suitable for pushing the armature against the

cradle. Advantageously, the member is a finger operatively connected to a resilient element by means of which it is possible to control, within predetermined values, the resilient force applied to the armature for assuring a steady clamping on the support means.

[0032] All the exemplary embodiments above indicated enable picking up the armature from the pallet either from above or from below. In the latter case, the base has an opening to allow lifting means to pass.

[0033] An advantageous exemplary embodiment that can apply to all the previous embodiments provides that with respect to the pallet the support means enable receiving an armature both with a commutator oriented in a first direction and with a commutator oriented in a second direction, opposite to the first. The support means are sized so that when the commutator is arranged in the first direction with respect to the pallet the armature belongs to a first dimensional class, whereas when the commutator is arranged in the second direction, the armature belongs to a second dimensional class, different from the first. This way, on a same production line and on a same pallet, when the pallet moves oriented in the first direction it means that the pallet carries parts of the first dimensional

class, whereas when the pallet moves oriented in the second direction it means that the pallet carries parts of the second dimensional class. The support means, in this case, have means for bearing the armature by the armature stack and means for holding the armature stack that are doubled.

[0034] In a second type of exemplary embodiments of the pallet according to the invention the portion having axial symmetry engaged by the support means is the shaft of the armature, the support means comprising in this case a first and a second support capable of approaching and/or moving away from each other with respect to the armature axis at the moment of receiving and/or releasing a portion of the shaft.

[0035] Advantageously, the first and second support means are capable of approaching and/or moving away from each other in a substantially axial direction with respect to the armature axis.

[0036] Alternatively, the first and second support means are capable of approaching and/or moving away from each other in a substantially radial direction with respect to the armature axis.

[0037] In a preferred exemplary embodiment, only either the first

or the second support means move at the moment of receiving and/or releasing the armature axis whereas the second or first support means respectively remain still.

[0038] Advantageously, actuating means are provided, for example, of pneumatic type, suitable for causing the mutual approaching and/or moving away of the first and second support means.

[0039] In a possible exemplary embodiment, at least one of the support means has an elongated portion movable in a substantially axial direction suitable for engaging with the corresponding portion of the shaft of the armature. The elongated portion is capable of inserting in the space set between the coils and the armature shaft so that it can work also in the case of armatures having a portion of the shaft that is short and close to the armature stack of sheets.

[0040] In this case, the elongated portion of the support means can be connected to the actuating means with a releasable connection so that it can be replaced by one of different size.

[0041] In an alternative exemplary embodiment, the moving away stroke of the first and second support means is biased by resilient means. Furthermore, the support means can have

an end shaped in order to provide substantially a bevel that makes easier the location from above the armature on the pallet. This way, at the moment of positioning the armature on the pallet the support means are elastically forced to move away from each other to allow the armature to fit correctly. After positioning, the resilient means urge the armature, thus preventing it from moving during its transportation. At the moment of picking up the armature by gripping means at a workstation the embodiment above described allows in any case an easy maneuver. This way the pallet has substantially "self-adjusting" supports, i.e., capable of conforming and adapting automatically to the size of the transported armature shaft.

[0042] If the support means can approach and/or move away from each other in a substantially radial direction with respect to the armature axis, they can be two jaws, preferably, having a substantially "V-shaped" surface suitable for receiving shafts of armatures of different size.

[0043] According to the invention, the exemplary embodiments above indicated enable picking up the armature from the pallet either from above or from below. In the latter case, the base has an opening to allow lifting means to pass.

[0044] According to another aspect of the invention, a method

for handling electric motor armatures on automatic production lines using a pallet, where the armatures comprise a plurality of portions having axial symmetry, in particular a shaft and an armature stack of ferromagnetic sheets driven on the shaft, provides that the armatures are carried on the pallet engaging at least one of the portions having axial symmetry and maintaining the armatures with axis substantially horizontal for preventing it from moving during its transportation.

[0045] In particular, the armatures are borne at the armature stack and at the same time held at the armature stack for preventing the armature from moving.

[0046] Alternatively, the armatures are carried on the pallet holding them at the shaft by support means capable of approaching and/or moving away from each other with respect to the armature axis same at the moment of receiving and/or releasing a portion thereof.

[0047] The exemplary embodiments above described enable making a pallet having high flexibility, i.e., capable of carrying armatures having different sizes.

[0048] Providing several support means in parallel, the pallet is capable of carrying a corresponding number of armatures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] Further characteristics and advantages of the pallet for handling electric motor armatures on automatic production lines, according to the present invention, will be made clearer with the following description of possible exemplary embodiments, with reference to the attached drawings, in which like reference characters designate the same or similar parts throughout the Figures of which:

[0050] -Figures 1 and 2 show a partial elevational view of a first exemplary embodiment of a pallet according to the invention, in two steps respectively of holding the armature on the pallet and lifting from below the armature from the pallet;

[0051] -Figure 3 shows a pallet similar to that of Figures 1 and 2 for receiving two armatures, cross sectioned according to two different planes;

[0052] -Figures 4 and 5 show respectively an elevational side view and a top plan view of an alternative exemplary embodiment of the pallet of Figures 1 and 2;

[0053] -Figures 6 through 8 show respectively an elevational side front view, side view and top plan view of an exemplary embodiment of the pallet of Figures 4 and 5;

[0054] -Figures 9 through 12 show diagrammatically the succession of steps for locating the armature on the pallet

relatively to the exemplary embodiment of Figures 4 and 5;

[0055] -Figures 13 and 14 show diagrammatically possible positioning solutions alternative to the embodiment shown in Figures 9 through 12;

[0056] -Figures 15 and 16 show respectively a front view and top plan view of a possible exemplary embodiment of the pallet according to the invention;

[0057] -Figures 17 and 18 show respectively a perspective view and top plan view of an exemplary embodiment of the pallet according to the invention with double support for each armature in two different opposite directions with respect to the pallet;

[0058] -Figures 19 and 20 show respectively a perspective view and top plan view of another exemplary embodiment of the pallet according to the invention with double support for each armature in two different opposite directions with respect to the pallet;

[0059] -Figures 21 and 22 show respectively an elevational side view and top plan view of a further exemplary embodiment of the pallet according to the invention;

[0060] -Figure 23 shows a top plan view of a second type of exemplary embodiments alternative to that of Figures

1 through 22 of a pallet according to the invention;

[0061] -Figures 24 and 25 show in an elevational side view the pallet of Figure 23 adapted to two different types of armatures;

[0062] -Figure 26 shows an elevational front view of the pallet of Figure 24;

[0063] -Figure 27 shows an elevational front view partially cross sectioned of the pallet of Figure 23 for highlighting the releasable connection between the elongated portion of the support and the stem of the actuating means;

[0064] -Figure 28 shows a top plan view of the support means of Figure 27 in detail;

[0065] -Figures 29 and 30 show a partially cross sectioned elevational side view of the support means of Figure 27 in two different positions of interaction with respect to the processed armature;

[0066] -Figures 31 and 32 show diagrammatically an elevational side view of two positioning steps of an armature on a pallet according to an exemplary embodiment alternative to that of Figure 23;

[0067] -Figure 33 shows a top plan view of the pallet of Figures 31 and 32; and,

[0068] -Figures 34 through 36 show diagrammatically a front view of a further exemplary embodiment of a pallet according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0069] With reference to Figures 1 through 22, some possible exemplary embodiments are shown, according to the invention, of a first kind of pallet for handling armatures 10 for electric motors, having a shaft 12 on which an armature stack of ferromagnetic sheets 11 and a commutator 13 are driven, on automatic production lines.

[0070] In particular, in this kind of pallet 1, shown according to different exemplary embodiments the engagement of armature 10 is provided by support means 5 that contact the armature stack of ferromagnetic sheets 11. More in detail, the pallet 1 comprises a base 2 having substantially rectangular shape and made of light material, for example resin, that can be reinforced with a plate of stronger material, on which the support means 5 are mounted.

[0071] In a first exemplary embodiment of the invention, shown in Figures 1 through 3, the support means 5 are two jaws 6 movable with respect to each other between a first and a second position. In the first position (Figure 1) the jaws 6 are approached radially to stack 11 of armature 10 and

engage with it firmly, whereas in the second position (figure 2) the jaws 6 are distanced with respect to stack 11 of armature 10, allowing gripping means 30 to lift and grip it from below at a workstation, here not shown.

[0072] The jaws 6 are mounted sliding transversally with respect to the armature axis 10 along a guide 15 and biased by resilient means 7. In particular, the jaws 6 slide along guide 15 running from the first to the second position forced by a releasing means 36 movable in a direction substantially orthogonal to the base 2 of the pallet 1.

[0073] According to the embodiment shown, the releasing means 36 has tapered side faces 37 to allow the conjugate sliding with rollers 9 connected to each jaw 6. Therefore, in the second position (Figure 2) the jaws 6 are affected by the resilient returning force that biases their moving away from each other, whereby when the releasing means 36 withdraw to the first position (Figure 1) a residual resilient force causes the jaws 6 to close on armature stack 11 and to block armature 10.

[0074] The releasing means 36 can be integral to a gripper 30 of pick up means lifting from below (Figure 1, 2 and 3), as well as to a gripper of pick up means coming from the above (Figure 14) of the work piece, and may have, in ad-

dition to that shown, whichever conjugate surfaces that slide or roll with respect to each other, causing the jaws 6 to move away from or to approach each other.

[0075] In Figure 3 the pallet can receive two armatures 10, holding both of them at the armature stack 11. In particular, the armature on the right is sectioned through a different plane from that on the left, showing respectively the lifting means from below 30 and the releasing means 36. They can be integral to each other or operated independently.

[0076] The jaws of Figures 1 through 3 can hold the armature and contain it axially, owing to their shape having double inclination.

[0077] Alternatively, as shown in Figures 4 and 5, the jaws 6 can hold the armature axially, and for bearing the armature a cradle 35 is provided formed by two rods 20, parallel to armature axis 10, fixed by vertical supports 21 to the base 2 of the pallet 1.

[0078] In the solutions of Figures 1 through 5, the pallet 1 thus arranged is capable of holding armatures with armature stack of different diameter 11 within the range of the resilient stroke between the first and the second position. In the case of Figures 4 and 5, the support on the rods 20 of

the cradle 35 can receive armatures 10 with armature stack 11 of different diameter, since the cylindrical armature stack 11 rests on the rods 20 along its generatrix lines.

[0079] An alternative exemplary embodiment is shown in Figures 6 through 8, where the jaws 6 have each an upper end 16, shaped in order to form substantially a bevel that makes easier the introduction from the above of the stack 11 of armature 10 onto the supports, and the lower end hinged to a horizontal axis 25. This way, the jaws 6 can move rotationally with respect to each other rotating about the hinge 25 between a first and a second position. In particular, the angular motion of each jaw 6 is biased by a resilient force suitable for carrying the jaws 6 to close on armature 10 after having positioned the latter on the support means 5. The pallet has also an identification block 41, of prior art, for automatic production lines, not described in detail.

[0080] Also in this case two rods can be provided that are arranged parallel 20 as a cradle for stack 11 of armature 10 between the jaws 6.

[0081] The succession of steps necessary for positioning armature 10 between the jaws 6 on the possible rods 20 of the

support means 5 is diagrammatically shown in Figures from 9 to 14.

[0082] In particular, Figures 9 through 12 show diagrammatically the case where the force necessary to oppose the resilient resistance to open the jaws 6 and to position armature 10 between them is produced completely by armature stack 11, sliding against bevelled end 16 under the action of the gripping means 30, which push from the above, but that could also act from below.

[0083] Figures 13 and 14 refer, instead, to the case where the introduction of armature 10 between the jaws 6 is aided by releasing means 36. In particular, in Figure 13 a releasing means 36 is shown in two parts with ends 37 that can be opened in the same plane of gripper 30. The ends 37 are shaped in order to be complementary with the ends 16 of the jaws 6. Therefore, once a portion of ends 37 are inserted in the end 16 of the jaws 6, the two parts that make up the releasing means 36 move away from each other according to the horizontal arrows, causing the armature to fit correctly 10 on pallet 1. In Figure 14 instead a wedge releasing means is shown in a different plane from that of gripper 30, in a way similar to Figures 1 through 3.

[0084] In Figures 15 and 16 a third exemplary embodiment is shown according to the present invention, with support means 5 arranged as a cradle 18 for armature stack 11. At least one portion of the cradle 18 is provided with a magnet 40. This way the portion of stack 11 of armature 10 located at the magnet 40 is magnetically attracted thus blocking the whole armature 10.

[0085] The pallet according to the invention can receive armatures of a same family, with an armature stack having diameter D +-Δ, whichever the shape and the size and the position are of the shaft, of the commutator, independently from whether the armature is wound or still unwound. This derives from this embodiment of the invention, which provides the engagement from outside of the armature stack blocks any axial movements, with means suitable for receiving armatures with armature stack also of different diameter.

[0086] According to an exemplary embodiment of the invention, on a same pallet support means can be provided in at least two couples, which can house armatures with armature stack of diameters very different from each other.

[0087] In a first example, the two couples of support means are arranged according to the same axis, but in order to re-

ceive different armatures depending from how they are oriented. With reference to Figures 17 and 18, a first couple of supports 5 at an average distance L can house armatures 10 having an armature stack with diameter D +-Δ whereas a second couple of supports 5' at an average distance = L + x can house armatures 10' having an armature stack with diameter D +- Δ'. In Figures 17 and 18 two double couples of supports 5 and 5' are shown, in order to carry two armatures 10 or 10' at a time. Straightforwardly, in Figures 17 and 18 a single armature 10 has been shown on a first couple of supports 5, whereas a single armature 10' has been shown on a second couple of supports not co-axial to the first. Actually each pallet carries normally either two armatures 10, oriented in a same way, or two armatures 10' oriented in a same way opposite to the previous.

[0088] The pallet 1, if it is carrying armatures 10 would proceed oriented in a direction, or in a opposite direction if it is carrying armatures 10'. In case the pallet has automatic identification blocks 41 and 41', of known technology, the system will detect the orientation of the pallet, and then the type of armatures transported, depending on which of the blocks 41 or 41' passes through an identification

point in a production line.

[0089] A similar embodiment as that of Figure 3 or Figure 6 can be provided on a pallet. In the latter case, the embodiment have double supports, where the supports on the right have nominal distance very different from that on the left, as shown in Figures 19 and 20.

[0090] A further exemplary embodiment of the present invention, shown in Figures 21 and 22, provides that above the cradle at least stabilizing finger is arranged movable that blocks armature 10, pushing it from the above towards below. Advantageously, the finger 26 is operatively connected to a resilient torsion element about a rotation pin 25, by means of which the resilient force applied to armature 10 can be controlled, within predetermined values, for assuring a steady clamping on the cradle formed by rods 20.

[0091] All the exemplary embodiments above described allow to pick up armature 10 from the pallet 1 either from the above or from below. In the latter case, as shown in the corresponding figures, the base 2 of the pallet provides an opening 3 to allow lifting means to pass 35.

[0092] Furthermore, all the different exemplary embodiments provided for the pallet, according to the invention, can be

used for armatures having different shape and size. For example, in Figures 17 and 18 a perspective view is shown of two possible armatures 10 and 10' of prior art and of different shape. Notwithstanding they have shaft 12 of different size and different stack height 11 they can be both be carried by pallet 1 along an automatic production line without any adjustment of the supports.

[0093] In Figures 23 through 36 some exemplary embodiments are shown of a second kind of pallet, alternative to that shown in Figures 1 through 22, according to the invention. In this case the engagement of armature 110 by the support means is effected at the shaft 110 by means of a couple of supports 121 and 131 mounted on the basis 2 of pallet 100.

[0094] In particular, the supports 121 and 131 are capable of approaching and/or moving away from each other with respect to the axis 115 of armature 110 at the moment of receiving and/or releasing a portion of the shaft 111. More in detail, the support means 121 are movable along the axis 115 of armature 110 whereas the supports 131 are fixed, or alternatively, they can be arranged at a distance from the movable supports 121 but only in a preliminary step (Figure 23 through 26). For example, in the

case shown in Figures 23 through 26 a rod 133 is provided mounted on the basis 2 parallel to axis 115 of armature 110 on which a support arm 131 snap fits and is arranged at a predetermined distance from support 121.

[0095] At the moment of receiving armature 110 from the above, the supports 131 can then be used as reference by the gripping means, not shown, for positioning the corresponding shaft ends 111.

[0096] In the case shown in Figures 23 through 30 the supports 121 have an elongated portion 122 movable in a substantially axial direction with respect to armature 110 for engaging with the corresponding shaft ends 111. In particular, the elongated portion 122 enters the space set between the coils 112 and shaft 111 of armature 110 in order to offer a higher support surface to the shaft ends 111 of armature 110 that has to be held. This possibility allows using pallet 100 also for carrying armatures 110 having a portion of the shaft 111 hidden between the coils and the armature stack 112 (Figures 27 through 30). The support 121 can be positioned with respect to armature 110 at the moment of receiving armature 110, or alternatively, a little time before, for example by actuators of pneumatic type 150 (Figures 29 and 30). As shown in de-

tail in Figure 27 the elongated portion 122 of the support 121 can be connected to the actuating means 150 and in particular to a stem 151 movable along an axis 155 parallel with axis 115 of armature 110. This can be made by a releasable connection, for example by a screw 160, or a pin, etc., so that it can be replaced by one of different size for making pallet 100 more flexible.

[0097] In Figures 31 through 33 an exemplary embodiment is shown alternative to that above described in which the supports 121 and 131 can move away from each other biased by resilient means 170. In particular, the supports 121 and/or 131 can have an end shaped in order to provide substantially a bevel that makes easier the location from the above of armature 110 on pallet 100.

[0098] As shown in detail in Figure 32, at the moment of positioning armature 110 on pallet 100 the movable supports 131 are elastically forced to move away from supports 121 to allow the armature 110 to fit correctly. In other words the distance between the supports 121 and 131 is self-adjusted in order to adapt to the length of the shaft 111 of armature 110. More in detail, the distance between the supports 121 and 131 changes from a starting value 11 to a value l2 depending on the length of shaft 111 of

armature 110 (Figure 33). Always with reference to Figure 33, the relative movement between the supports 121 and 131 can be made mounting the supports 131, or also the supports 121, on guides 175.

[0099] Once armature 110 has been located onto the supports 121 and 131 the resilient means 170 create a locking force F on armature 110, thus preventing it from moving during its transportation. When armature 110 has to be picked up from pallet 100 by gripping means, not shown, in a workstation the embodiment above described allows, in any case, an easy manoeuvre.

[0100] Notwithstanding in the exemplary embodiments above described the approaching and/or moving away of the supports 121 and 131 is effected axially, it is also possible to move the supports 121 and 131 along a direction orthogonal to the armature axis 115 (Figures 34 through 36). In this case the supports 121 and 131 can be jaws, at least one of which mobile, preferably having a substantially "V-shaped" surface in order to receive shafts 111 of armatures 110 of different size. In particular, from a starting condition where the jaws 121 and 131 are approached to each other (Figure 34) the jaws are withdrawn pneumatically (Figure 35) for eventually closing them on

the shaft 111 of armature 110 (Figure 36). This exemplary embodiment provides one or more couples of jaws for each armature 110, in the latter case two portions of shaft opposite with respect to the armature stack 112 can be engaged.

[0101] The two types of pallet provided by the present invention, as above described, allow to carry a wide variety of armatures with different size and structure along automatic production lines. Even if different exemplary embodiments have been described referred to the portion of the armature engaged by the support means, this does not exclude that the two exemplary embodiments of pallets can be adapted or combined with each other for engaging with desired portions of the armature.

[0102] The foregoing description of a specific embodiment will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt for various applications such an embodiment without further research and without parting from the invention, and it is therefore to be understood that such adaptations and modifications will have to be considered as equivalent to the specific embodiment. The means and the materials to realise the

different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.